(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 034 643**
A1

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **80102860.6**

(51) Int. Cl.³: **A 63 C 5/00**

(22) Date of filing: **22.05.80**

(30) Priority: **15.02.80 US 121753**

(43) Date of publication of application:
02.09.81 Bulletin 81/35

(84) Designated Contracting States:
AT CH DE FR IT LI SE

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(54) **Split-tail ski.**

(57) A ski (2) has an end section (10) provided with cut-out that forms a pair of spaced apart tail sections (15). The cut-out has a width (W), at the tail end (8), that is at least about one-fourth (25%) of the ski width (W) at the tail end (8). The cut-out extends forwardly into the end section (10) over a length (L) which is from between 2 to 10 times or more the width (W) of the cut-out at the tail end (8) of the ski (2). The cut-out is machined into the ski end (10) and ski surfaces exposed thereby are protected with sheathing bonded to such surfaces by providing a plug of sheathing material that is shaped to correspond to the shape of the cut-out and bonding the entire plug to the exposed surfaces to effectively close the cut-out with the plug. Thereafter, the center portion of the plug is severed along a line parallel to but spaced from the exposed core surfaces.

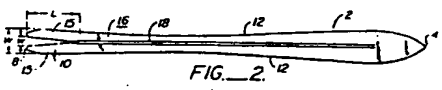

FIG. 2.

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SPLIT-TAIL SKI

Background of the Invention

In the evolution of skis, particularly of alpine skis for high speed downhill skiing, skis made of increasingly exotic material in accordance with evermore sophisticated manufacturing techniques have replaced the earlier simple wooden skis. Presently skis having lightweight cores, particularly honeycomb cores surrounded by a variety of surfacing material are generally considered to constitute the most advanced state of the art. The surfacing materials are typically structurally integrated with the cores and form high strength box members around the core which give such skis a virtually permanent shape memory, high torsional strength, as well as the desired longitudinal and lateral rigidity/flexibility characteristics. U. S. Patents 3,740,301 and 4,068,861, owned by the assignee of the present invention, disclose and claim a particularly advantageous ski of this type.

Although ski designers are not always in agreement as to what constitutes the ideal ski and what characteristics it ought to have, it is generally agreed that a high performance ski requires relatively high torsional and lateral rigidity while its longitudinal rigidity and/or flexibility is varied according to the skier's preferences, the terrain and/or the snow conditions for which the ski is intended and the like. Prior art skis have been desinged and constructed with these general requirements in mind.

Aside from a ski's durability, the ultimate test for judging its quality is usually the manner in which it performs during skiing. Since skiing is a dynamic sport in which conditions, speed, terrain and the forces to which the ski is subjected vary continuously and unpredictably, and since it is at least impractical if not impossible to objectively observe the manner in which a ski performs during skiing, the designing of skiis has been more an art than a science. It was generally accepted that for any given person some skis perform better than others depending upon that person's skiing ability, strength, weight, and a host of other objective as well as subjective considerations.

Since turning constitutes the most difficult aspect of skiing, more attention was directed thereto. For example, it has been determined that skis having sides which are slightly concavely curved are easier to turn than others. Similar observations have been made in regard to the weight, the lighter the ski, the easier it usually turns. Consequently, the most advanced skis are relatively lightweight and typically have concavely curved sides.

Another aspect of ski design which has in the past received some attention is the ability of a ski to "hold" when traversing a sloping surface. In such instances, the edge of the ski must cut into the snow (or ice) to prevent the skis from slipping laterally or sideways. To increase the holding power of such skis, it has been suggested to split the tail of the ski into two or more longitudinal sections by forming e.g. sawing one or more longitudinal slits in the ski. The purpose of such a construction is to permit the tail sections to deflect upwardly while traversing a slope so as to have two or more ski edges which can cut into the snow, thereby decreasing the danger of lateral slippage. Austrian Patent 238,074, German Offenlegungsschrift 1,428,958, the corresponding Swiss Patent 430,540, Norwegian Patent 94,867 and as U. S. patent 3,319,276 (for a water ski) disclose such split tail skis.

In all instances, the ski ends are simply slitted with no attention given to the size of the slit or of the

resulting multiple tail sections or how such slits can practically be formed in today's composite ski structures, particularly those employing lightweight cores and surrounding box members. Presumably, the split tail skis disclosed in these patents and publications were considered made of an essentially uniform material, such as laminated wood, a ski material that was and in some instances still is widely used, particularly for lower cost skis. In such a case, the slit can be simply sawed into the ski, the resulting side surfaces facing the cut-out can be painted and the ski is ready for use. This does not apply, however, to composite skis because the slits would cut into the core, thereby exposing the core which is not acceptable.

U. S. patent 3,534,972 discloses a ski which constitutes another attempt to improve its performance by essentially "hollowing out" the running surface with a groove which diverges rearwardly in both the lateral direction and in the direction of its height. The objective of that ski is to provide extra vertical lift during skiing at the tail of the ski. The divergence of the groove is sufficiently large so that the groove intersects the top surface of the ski in the vicinity of the tail, thereby dividing the ski end into two side by side, independently flexible tail sections.

Although, it is not clear how the stated effects are achieved with a ski constructed in accordance with that patent, the fact that the running surface tapers upwardly and becomes almost as wide as the ski towards the tail of the ski renders such a structure totally unusable for today's composite skis since the large groove takes up most if not all of the space occupied by the lightweight center core. Even if such a ski were constructed of a homogeneous material, such as a wood or plastic, it weakens the ski to such an extent that it is unlikely to withstand the rigors and high impact forces typically encountered during high speed alpine skiing. Further, in the opinion of expert skiers, such a construction of the running surface f a ski is likely to detract, not enhance, the perf rmance of the ski.

German Offenlegungsschrift 2,704,858 discloses a ski structure similar to that disclosed in the U. S. patent discussed in the preceding paragraphs except that it does not include the rearwardly diverging bottom groove. Yet, a ski constructed in accordance with this German publication is said to have the opposite effect from that of a ski constructed in accordance with the U. S. patent, namely a reduction in the vertical lift encountered at the ski tail. This inconsistency makes it virtually impossible to reconcile the two disclosures.

Irrespective thereof, however, the German publication discloses to provide the ski in the vicinity of its tail with a cut-out, either open or closed at the tail, to permit snow from protruding upwardly through the cut-out during skiing. No significance is attached to the shape or size of the cut-out or the resulting tail sections of the ski. The publication further proposes to connect the ski tail sections with an upwardly and rearwardly diverging, funnel-shaped device, similar in appearance and apparently also in function to the rearwardly diverging groove of the above discussed U. S. patent so as to increase the rigidity of the tail sections of the ski while enhancing the relative rearward flow of snow which protrudes upwardly through the cut-out. Again, there is no suggestion how the cut-out can be efficiently formed in composite skis having lightweight cores. Further, in contrast to the other prior art references discussed herein, this publication seeks to reduce the greater flexibility of the tail sections which leaves one to wonder what, if any advantages can be attained from a split tail ski and how is the split to be formed in order to maximize the performance of the ski.

In view of these shortcomings of skis constructed in accordance with the above summarized prior art, the inconsistancies contained therein and, undoubtedly, in view of other factors including a lack of understanding why ski tails should be split, and therefore, to what extent the tails should be split, the shap and form f the resulting cut-out and the like, split tail skis have n ver become accepted. In

fact, it is doubtful that any have ever been sold on a commercial basis.

Summary of the Invention

The present invention is directed to an improved construction for split tail skis which is ideally suited for use in connection with composite skis having lightweight cores, especially honeycomb cores and which is further based on a heretofore unavailable recognition of what enhances the performance of skis. Consequently, a ski constructed in accordance with the present invention has a split tail defined by a cut-out which is carefully shaped and dimensioned so as to positively affect the performance of a ski, especially its ability to execute turns on even difficult, e.g. steep slopes having a hard or icy surface where prior art skis tended to slip excessively. Further, the present invention provides a means which assures a durable and economical encapsulation of the entire core even though the cut-out intersects it.

Conceptually, applicant has discovered that the heretofore accepted strength, rigidity and deflection characteristics for a ski continue to be valid. That is, a ski should have a relatively high torsional and lateral rigidity while its longitudinal rigidity can be fine-tuned for various snow and/or terrain conditions as well as skier preferences. In addition thereto, applicant has determined that the tail section of the ski critically influences the ski's performance in a turn.

In particular, applicant has determined that during the execution of a turn, the tail end of the ski performs a critical holding function. If the turn is properly executed, the ski, at all times, moves in a forward direction while it slowly rotates about an axis believed to be somewhere at the forward portion of the ski to thereby carve a smooth turn into the snow, that is to form a track having a relatively constant curvature, so that the width of the track at the turn is not significantly wider than the width of the ski taking into account, of course, a certain degree of widening of the track due to the rotational travel component of the

ski. Frequently, however, such smoothly carved turns are difficult to perform, particularly by skiers other than expert skiers.

Normally there is side slippage at the tail end and a corresponding loss of control over the execution of the turn which is both undesirable since it interrupts smooth skiing and potentially dangerous because it can lead to a spill and possible injury. In accordance with the present invention, such side slippage of the ski end during a turn (which must be distinguished from side slippage of a ski when traversing a slope) is greatly reduced even for skiers having only average skills by narrowing the available running surface at the ski tail to thereby correspondingly increase the unit pressure acting on the running surface at the ski end. This increase in the running surface pressure at the ski tail, rather than a heretofore presumed digging in of the ski edges, is what provides ski constructed in accordance with the present invention with far superior stability during turns. At the same time, it is necessary not to compromise the performance of the ski during other skiing maneuvers, e.g. during traversing, straight skiing, skiing in deep snow and the like. The latter continue to require a ski which, for downhill skiing, is relatively wide, typically having a width of about 2 to 4 inches, and which is substantially flat over its entire longitudinal and transverse extent.

The term "substantially flat" as applied to the running surface of the ski is used to indicate a surface that is otherwise flat except for the conventional longitudinal running groove and the ski camber.

Accordingly, a ski constructed in accordance with the invention has an end section provided with cut-out which forms a pair of tail sections that are spaced apart by the cut-out. The cut-out has a width, at the tail end, that is at least about one-fourth (25%) of the ski width at the tail end and, preferably, which li s in the range of about one-half (50%) to two-thirds (67%) of the ski width. Further, that cut-out extends forwardly into the end section v r a length which is at least twice the width of the cut-out at

the tail end of the ski and which preferably is about 2 to 10 times the cut-out width. In the presently preferred form, the cut-out when incorporated in a ski having a width of approximately 50mm has a width of about 35mm and a length of about 170mm for a presently preferred length to width ratio of about 5:1. The remainder of the running surface of the ski remains substantially flat.

Maximum running surface pressure is desired in the vicinity of the tail end to obtain optimal performance from the ski. Although excellent results are obtained when that pressure is maintained over most or the entire length of the ski, as by making the cut-out generally rectangular, such a construction causes stress concentrations in the areas where the tail sections join the remainder of the ski. To eliminate or at least reduce stress concentrations, the cut-out preferably has a triangular shape to correspondingly increase the cross section at the forward end of the tail sections where they join the remainder of the ski.

Expert skiers, in numerous tests, have confirmed the fact that a ski constructed in accordance with the present invention as summarized in the preceding paragraphs performed superior during a turn to any other ski, that is it holds during the turn, smoothly carves it and shows a much reduced propensity for tail slippage during turning. At the same time, the ski exhibits all the desirable characteristics of conventional skis including high stability during straightaway skiing, traversing slopes of varying degrees of steepness, skiing in deep snow (powder) and the like. Applicant believes that this is a result of limiting the increased running surface pressure to only the relatively short tail sections which, normally, experience relatively less pressure due to the weight of the skier, which is the major source of pressure during straightaway skiing. Thus, the formation of the relatively wide cut-out and correspondingly narrow tail sections does not adversely affect the overall pressure balance of the running surfac except during a turn. In turns, however, the snow pressure on the tail increases and by forming the cut-out as above described the ski carves much better into the snow and thus h lds much better.

Another aspect of the present invention enables the construction of a ski with a split tail in accordance with the present invention even though the ski is of a composite construction and has a lightweight, e.g. honeycomb, core. The present invention recognizes the fact that it is presently economically not desirable to manufacture a composite ski with a lightweight core that already includes the desired cut-out. This leads to both manufacturing difficulties and the possibility that the finished ski has manufacturing defects in areas of the cut-out not readily accessible and/or visible. Accordingly, the ski of the present invention, or at least its core sandwich if the core is a honeycomb core, is first made up as a conventional ski with a solid end section. A cut-out is then machined, e. g. sawed, into it which has the desired shape and size. By necessity this requires cutting into and thereby exposing the core. Difficulties are encountered when protective sheathing, such as plastic sidewalls, is applied to the side surfaces of the core that are exposed when the cut-out is machined since the confined space of the cut-out and interior corners thereof make it difficult to form an appropriate bond between the sheathing and the core, seal that bond, and make it look attractive, the latter being highly important in the marketplace.

In accordance with the present invention, this is overcome by applying the sheathing in a form of a solid piece or plug of sheathing material shaped to correspond to the shape of the cut-out machined into the ski and bonding the entire piece to the exposed core surfaces. This effectively closes the previously formed cut-out with the plug. Thereafter, the center portion of the plug is severed, e.g. cut or preferably sawed, along a line parallel to but spaced from the exposed core surfaces. The remaining sheathing forms a one-piece integral sidewall for the ski which face the cut-out and extends over the entire length of the core surfaces.

By constructing the sheathing of a single pi ce, the formation of interior corners formed by an overlapping sheathing section, difficulties in aligning such corners, sealing them, etc. are avoided. At the same time, the

unitary sheathing construction renders the ski highly attractive. Most importantly, however, the plug is readily handled and easily bonded during the manufacture of the ski. Consequently, the present invention enables the construction of split tail skis without significantly increasing manufacturing costs.

Brief Description of the Drawings

Figure 1 is a side elevation of a composite ski constructed in accordance with the present invention;

Figure 2 is a bottom view of the ski illustrated in Figure 1;

Figure 3 is an enlarged plan view of an end section of the ski illustrated in Figure 2;

Figure 4 is an enlarged end view, in section, and is taken on lines 4-4 of Figure 3;

Figure 5 is a plan view similar to Figure 3 but illustrates the end section of the ski at an intermediate stage during its manufacture when the cut-out in the end section is filled with a plug of sheating material; and

Figure 6 is an end view, in section, similar to Figure 4 and is taken on line 6-6 of Figure 5.

Description of the Preferred Embodiments

Referring to Figures 1-4, a ski constructed in accordance with the present invention has a forward ski tip 4 defined by an upwardly curved tip section 6, a tail end 8 and an end section 10 which extends from the end towards the tip. The ski has ski sides 12 which exhibit a slight concave curvature, a top surface 14 and a substantially flat running surface 16 including a longitudinally extending, conventional groove 18. The width of the ski extends in the direction of dimension "W" while the thickness of the ski extends in the direction of dimension "t".

Structurally, the ski comprises a honeycomb core 20 which extends over substantially the full length of the ski although it may terminate short of tip 4 and tail end 8. The core has honeycomb cells 22 which extend in the direction of the thickness f the ski, that is they are essentially perpendicular to the running surface 16. Upper and lower facing

24, 26 are securely bonded to the corresponding faces of the honeycomb core and form therewith a relatively rigid, high strength but lightweight honeycomb sandwich 28. The facings may be made of a variety of materials. Preferably, however, the facings are made of fiber reinforced resin, commonly referred to as "prepeg" material such as is disclosed, for example, in the above mentioned commonly owned U. S. Patents 3,740,301 or 4,068,861.

Anyone of a number of commercially available, low friction, plastic ski materials is applied to the underside of the lower facing 26 and forms a ski base 30 which extends over the entire length and substantially the entire width of the ski. The underside of the base material defines both the running surface 16 and the running groove 18 of the ski. Metal, e. g. steel edges 32 form the outermost part of the running surface and they are conventionally affixed to the ski by means of a relatively narrow, inwardly extending web 34 which is secured, e.g. bonded, to the lower facing at the base.

The top surface 14 of the ski is defined by an impact resistant sheet 36, usually a plastic sheet, which is bonded to the top surface of the upper honeycomb facing 24. The ski sides 12 are defined by similar impact resistant plastic side walls 38 which are bonded to outwardly oriented sides 40 of the honeycomb core. As so far described, the construction of the ski is entirely conventional. Detailed elaborations are therefore not necessary.

The end section 10 defines a rearwardly open cut-out 42, which in the preferred embodiment of the present invention, has a generally triangular configuration with forwardly diverging sides defined, initially, by side surfaces 44 of the honeycomb sandwich 28 which face towards the cut-out, i.e. towards the longitudinal center line of the ski. The cut-out defines spaced apart tail sections 15 of the ski. As mentioned above, the cut-out is machined into the ski, either into the honeycomb sandwich 28 or at a later point during th manufacturing process, e.g. after the plastic base 30, top sheath and/or sidewalls 38 as w ll as

steel edges 32 have been appropriately attached to the sandwich.

The cut-out has a width "w" which is at least about 25% and preferably between about 50% to 67% of the ski width "W" at the tail end 8 of the ski. The length "L" is at least about 2x "w" and preferably in the range of between about 2x to 10x "w". Excellent results have been obtained with "L" equal to about 5x "w". Sheathing 46 of an appropriate thickness, preferably of approximately the same thickness as ski sidewalls 38, is applied to the inwardly facing sandwich side surfaces 34 so that the entire sheathing is constructed of a single, integral piece of sheathing material to eliminate corners where sheathing material would otherwise overlap and, consequently, where individual sections would have to be aligned and secured to each other.

To enhance the earlier discussed unit pressure on the running surface in the area of the tail section 10 which longitudinally overlaps cut-out 42, the outer ski edge 12 may be cut back so that end portions 48 of the ski sides converge in a rearward direction as is best shown in Figure 3. If desired, suitable protective plates (not separately shown) may be secured to the end of the ski so as to protect it from damage to the composite ski structure when the ski is placed upright on hard surfaces during storage or transportation.

Referring now briefly to Figures 3 and 5, to facilitate the manufacture of the ski of the present invention, and in particular of the cut-out, the present invention contemplates to initially form at least the sandwich 28 and, if desired, substantially the complete ski including its base, sidewalls and/or top protective layer before cut-out 42 is machined into the sandwich of the ski. Once the cut-out has been machined and the side surfaces 34 (defined by the sandwich or by the entire ski) are exposed, a plug of sheathing material 50 which has a thickness equal to the thickness of the sandwich or the ski at the cut-out and a shape equal to the shape of the cut-out is inserted into the cut-out until the converging sides 52 of the plug contact the opposing sides of the sandwich. A suitable bonding agent is

placed therebetween and the plug is pressed into the cut-out. Upon setting of the bonding agent, the plug forms an integral part of the sandwich or the ski.

Next, center portion 54 of the plug is severed, preferably by sawing along cutting line 56 which is parallel to and spaced from the sandwich (or ski) side surfaces 44 a distance equal to the desired thickness of sheathing 46. Upon completion of the sawing operation, the center portion of the plug drops out and the remaining sheathing 46 covers the sandwich side surfaces and thereby fully encapsulates the core in conjunction with the base, the sidewalls and the top layer applied about the sandwich.

As an alternative a plug 57 can be premolded from the desired sheathing material so that it comprises a pair of converging walls 58 interconnected by a relatively thin transverse web 60 as is illustrated by phantom lines in Figure 6. This alternative has the advantage that it reduces material waste. After the converging sides of the premolded plug 57 have been bonded to the inwardly oriented side surfaces of the sandwich, the horizontal web 60 is severed in the manner described above so as to leave the cut-out 42 open with the sheathing 46 bonded to the remainder of the ski.

The heigth of the plug 50 (or 57) is determined by both the thickness of the ski at the tail section 10 and the particular manner in which the plug is applied. In Figure 4, sheathing 46 is illustrated to extend from the running surface 16 to the top surface 14. Typically, such a construction will be employed when the plug is inserted after the base 30, edges 32, top sheet 36 and sidewalls 38 have been applied to the honeycomb sandwich 28, in which event, the cut-out is originally machined into the entire ski, that is including the base and top sheet. If the cut-out is machined into the sandwich 28 before the base and the sidewalls are applied to it, the plug 50 (or 57) will have a heighth equal to th thickness of the sandwich only. In such an event, the base and the top sheet will normally be applied over the plug and the center portion 54 of the plug, together with the

overlapping portions 62, 64 of the base and top sheath, respectively, will be severed along cutting line 56 in the above described manner.

CLAIMS:

1. In a ski having a tip and a tail end at respective ends thereof, a width between sides of the ski, and a thickness between a top surface and a substantially flat running surface of the ski, a honeycomb core with honeycomb cells substantially parallel to the thickness of the ski, an upper material layer defining the top surface and a lower facing defining the running surface, the layer being securely connected to the core so as to define a honeycomb sandwich therewith, and sidewalls defining the sides of the ski and attached to the sides of the core so as to encapsulate the core with the layer and the sidewalls, an end section of the ski defining a cut-out extending from the tail end towards the tip, characterized in that the end section comprises a cut-out having a width at the tail end which is at least 25% of the width of the ski at the tail end.

2. A ski according to claim 1 characterized in that the cut-out has a length of between about 2 to 10 times the width of the cut-out at the tail end.

3. A ski according to claim 1 wherein the honeycomb core includes a portion that extends rearwardly into the end section past a forwardmost end of the cut-out and that forms first and second, generally longitudinally extending honeycomb side surfaces facing the cut-out, characterized in that a protective sheathing is applied to the side surfaces so as to encapsulate the honeycomb portion, whereby the sheathing defines the lateral extent of the cut-out.

4. A ski according to claim 3 characterized in that the sheathing on the side surfaces is integrally constructed of the same material.

5. A ski according to claim 5 characterized in that the sheathing is attached to the side surfaces by securing a plug of sheathing material to the side surfaces having substantially the shape of the cut-out, and wherein a part of the sheathing material disposed in the cut-out is severed from the sheathing after the plug has been secured to the honeycomb side surfaces.

6. A ski having a tip and a longitudinally spaced apart tail end, longitudinal sides, a substantially flat running surface and a top surface, a honeycomb core extending over substantially the length of the ski having honeycomb cells substantially perpendicular to the running surface; upper and lower material layers rigidly secured to the core to define the upper surface and the running surface and to form in conjunction with the core a relatively rigid honeycomb sandwich; wall means applied to sides of the core defining the ski sides; the core and the layers forming a cut-out extending over the full thickness of the ski from the tail end towards the tip and bordered by side surfaces of the core and the layers establishing the width and length of the cut-out characterized by a honeycomb core protective sheathing applied to all honeycomb core side surfaces and integrally constructed of a single piece of sheathing material, the side surfaces and the sheathing being shaped and sized so that the width of the cut-out at the tail end is at least about one-half the width of the ski at the tail, and so that the length of the cut-out is at least about 170mm and at least about 2 times the width of the cut-out at the tail end.

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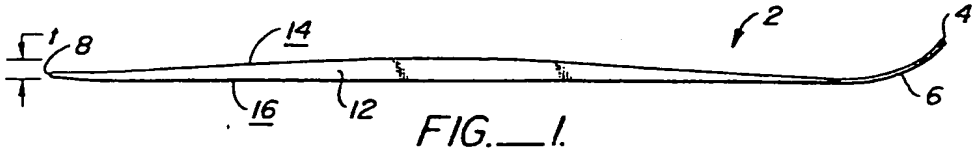

FIG. 1.

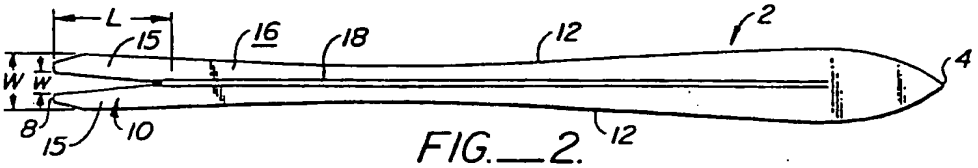

FIG. 2.

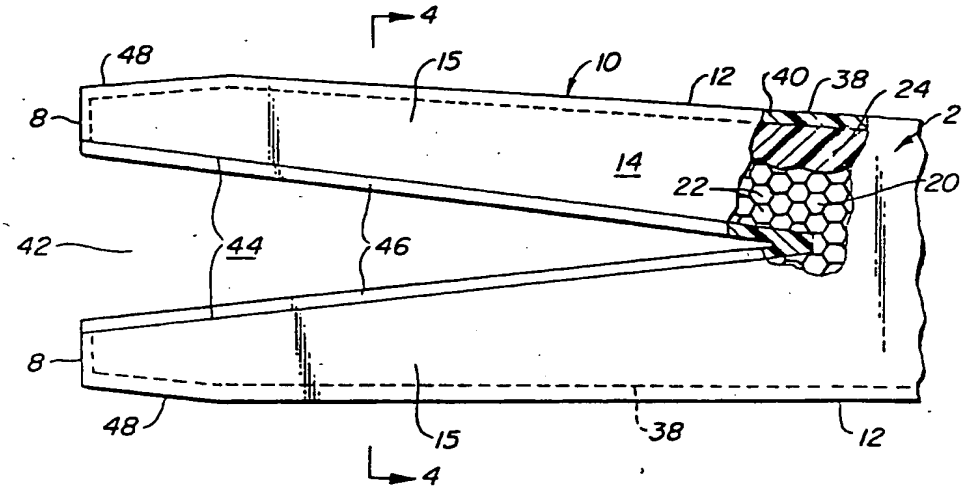

FIG. 3.

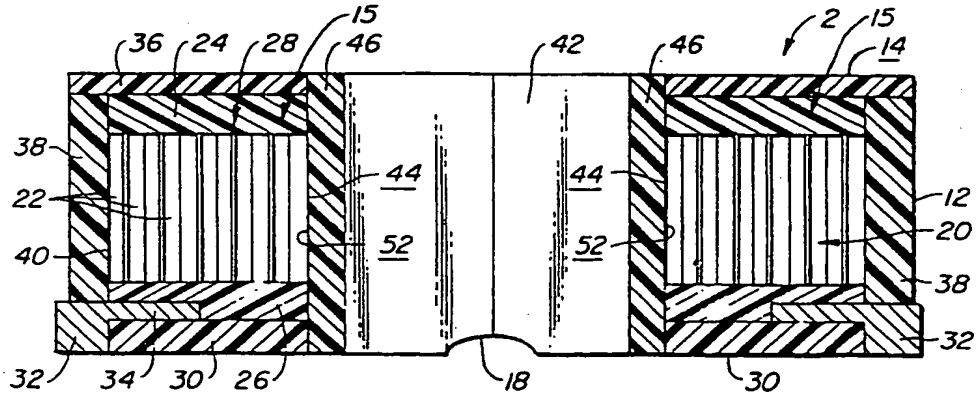

FIG. 4.

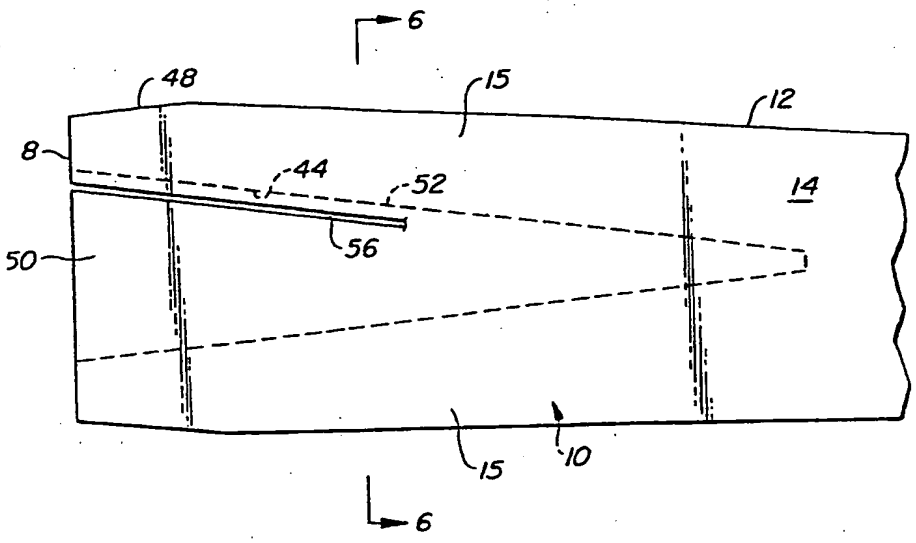

FIG. 5.

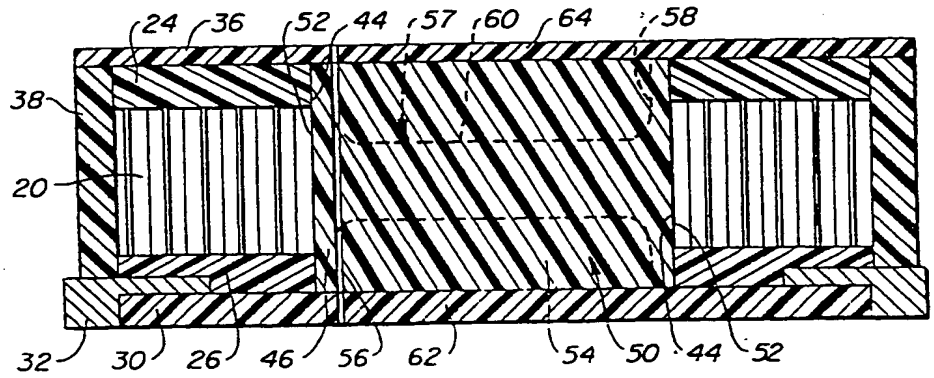

FIG. 6.

European Patent Office

EUROPEAN SEARCH REPORT

Application number
EP 80 10 2860.6

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
D	DE - A1 - 2 704 858 (HILLEPRANDT) * claims 1 to 4; fig. 2 * --	1,2,6-8
D	US - A - 4 068 861 (ZEMKE, JR.) * claim 1; fig. 1,3 * --	1,6
D,A	US - A - 3 534 972 (SALERNO) * claim 1; fig. 1, 2 * --	
D,A	AT - B - 238 074 (KÄSTLE) * claims 1, 2 * --	
D,A	DE - A - 1 428 958 (RITTER) * claims 1, 3 to 5; fig. 1 to 3 * --	
D,A	NO - C - 94 867 (VESTVOLD) * claim 1; fig. 2 * --	
A	US - A - 3 549 162 (COUTTS) * claim 1; fig. 2 * --	
A	US - A - 3 724 866 (KAPLAN) * fig. 2, 3, positions 12, 13 * ----	

CLASSIFICATION OF THE APPLICATION (Int Cl ³)

A 63 C 5/00

TECHNICAL FIELDS SEARCHED (Int Cl ³)

A 63 C 5/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Berlin	26-02-1981	DROPMANN